availability using a 0 degree elevation at 68% (32% outage).[25] Final Analysis agrees that the elevation requirement has a direct impact on availability and should not be unnecessarily restrictive.

As another example, in connection with coordination required with DOD, Leo One USA itself proposes using a more accurate approach to orbit prediction than is necessary.[26] Specifically, Leo One USA proposes using numerical techniques to improve upon the analytical approach used by NORAD, which Leo One USA deems to be "old and not very accurate,"[27] and to provide "low orbit prediction accuracy."[28] The numerical approach supposedly would provide more appropriate orbit prediction within 100 meters of the actual orbit for a period longer than two weeks. Final Analysis submits that this approach may be theoretically sound, but is lacking in practicality. There is no need, in the context of NVNG MSS systems, for such prediction accuracy. Typical NVNG satellites travel at 8 km (8,000 meters) per second, and have footprints larger than 5,000 km (5,000,000 meters) in diameter. Orbit prediction within 100 meters is relatively meaningless, and essentially useless, in such dynamic circumstances. On the other hand, use of the algorithms proposed by Leo One USA would add considerable resource and capability requirements to an NVNG MSS system to support the necessary calculations. Given the simple attitide maintenance planned to be incorporated in the NVNG MSS satellites and the simple gateway antennas that

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[25] This calculation is even less favorable than Final Analysis's calculation of approximately 65% global average availablity.

[26] Leo One Comments, Appendix E pp. 51-56.

[27] Id. at 52.

[28] Id. at 56.

are proposed to be used, efforts to achieve accuracy above and beyond what the DOD (NORAD) finds acceptable for its own use, and which would impose additional costs approximating those of a Big LEO system, is not justifiable. Final Analysis believes that Leo One USA's suggestion on this matter reflects a lack of understanding of the real world requirements of balancing effective coordination against unnecessary cost and urges that it be rejected.

While Leo One USA apparently would willingly impose greater complexity on itself and others in some respects, it underestimates complexity in other respects. For example, with respect to sharing with NOAA MetSats, Leo One USA suggests that "time-sharing is relatively minor for a constellation like the one proposed by Leo One USA....and [that] calculation of interference zones...is straight forward and easily accommodated with simple computational algorithms."[29] However, in this statement Leo One USA significantly underestimates the complexities of coordinating time sharing among dynamic, non-sun synchronous (for Little LEO systems only), global constellations in a service that has constantly varying customer data acquisition and transmission routines. Leo One USA itself acknowledges that such coordination with the RNSS system is "extremely difficult because of the limited spectrum and the dynamic time varying nature of the useable spectrum during each orbital revolution."[30] While the RNSS satellites operate only over water, the NOAA MetSats operate over land and sea, which should (and does) even further complicate time sharing in the latter case.

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[29] Leo One Comments at 47.

[30] Leo One USA Comments, Appendix E at 58.

A further example is the additional cost burden that would result from the requirement that feeder link or "gateway" channels be periodically shut off. Leo One USA summarily concludes that turning off a gateway channel for a small period of time would be "acceptable."[31] Leo One USA fails to reconcile its conclusion with the fact that a satellite in a Little LEO system, and especially in a 48 satellite constellation such as that proposed by Leo One USA, will be in contact with a gateway channel practically every minute. With spacecraft overhead, continuous communication with the gateway must be accommodated. As discussed explicitly in Final Analysis's Comments,[32] feeder links must be dedicated and cannot be shared. Significant outages on vital communication links between the gateway and the satellites resulting from periodic gateway outages will hardly allow an operator to maintain basic system reliability let alone deploy a fully competitive (i.e., near real time) system.

Finally, also in connection with coordination with the NOAA MetSat band segment, Leo One USA offers a "simplified" frequency sharing concept requiring the Little LEO satellites to step or hop to the opposite NOAA MetSat band segment whenever a NOAA MetSat satellite footprint overlaps that of a Little LEO satellite horizon. This again reveals a lack of consideration or understanding of how NVNG MSS coordination will work in practice.[33] As discussed above, coverage outages in such constellations are dynamic and

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[31] See Leo One USA Comments at Appendix E, 6.

[32] See Final Analysis Comments at 16-17.

[33] In fact, there are several technical anomalies in Leo One USA's presentation that raise serious questions as to their understanding of the satellite technology involved in this service. For example, on the issue of the proposed 48 hour reset signal (Notice at ¶ 63, while Leo (continued...)

evolving phenomena, changing continuously with time and geography. Thus pre-computing and instructing satellites for constant frequency change schemes, while technically feasible, require continuous attention and significant resources. More importantly, such a concept would require a subscriber terminal designed to accommodate frequency changes on receive.[34] While it is possible, via uplink commands, to instruct satellite frequency change at a specific time, it is not a trivial effort to ensure that user terminals may be made "smart" enough (cheaply enough) so that millions of them can reliably change their receive frequency

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[33](...continued)
One USA launches into an extended and rather academic discussion of this issue, (Leo One Comments, Appendix E at 11) it is simple enough to say, as Final Analysis has (Final Analysis Comments, Exhibit 2 at 8-9) that the satellite would run out of power before the end of the 48 hour period. More curious, Leo One has proposed a system of 48 satellites using eight orbits of 6 satellites per orbit plane. However, in its Application, and again in Table I of Appendix F of its Comments, Leo One USA suggests that these satellite planes are spaced at 45 degrees, giving Right Ascensions of 0, 45, 90, 135, 180, 225, 270 and 315 degrees. As proposed by Leo One USA, satellites will be traversing in opposite directions while effectively sharing only four orbit planes. As proposed by Leo One USA, satellites traversing in opposite directions will share orbit planes. Final Analysis raises these illustrative issues by way of explanation as to why Final Analysis does not accept Leo One USA's assessment of the feasibility of various sharing criteria and urges the Commission not to adopt sharing criteria based upon Leo One USA's assertions regarding the practicality of implementation.

[34] See Leo One USA Comments at 46-48. Leo One USA fails to recognize that frequency-hopping would require that multiple receivers be placed in the terminals to communicate with the "hopped-to" frequency, and that the introduction of multiple receivers would necessarily increase the cost of Little LEO terminals, even though market evidence suggests that users are price sensitive with respect to switching terminals. Leo One USA's comments also are internally inconsistent in that they suggest on the one hand that coexistence between NOAA and a Little LEO operator is a simple matter of frequency-hopping while asserting elsewhere that there will be a complete blockage of the Little LEO operator when its satellite is within the footprint of two overlapping NOAA satellites (and therefore no frequency is available to "hop to"). Leo One USA Comments at 46-47 and Appendix E at p.16. As discussed further below, Final Analysis believes that Leo One USA's comments reveal a certain lack of understanding of the complexity of implementing global NVNG MSS systems with dynamic coordination requirements, and seriously underestimates the impact of cost factors on the marketability of services.

to receive the appropriate signal. Such a plan will increase cost, reduce reliability, and potentially increase the number of transmissions from the satellite to the terminals.[35] Most certainly user terminals would be too expensive to enable NVNG MSS operators to effectively compete in many market segments.

In summary, while Final Analysis agrees that time sharing may be implemented,[36] the Commission must remain cognizant of the fact that sharing constraints not only will impose coverage limitations on second round licensees while first round licensees remain unencumbered by such obligations but also will impose additional costs. Thus, time sharing creates a double competitive disadvantage for second round licensees. In view of this, Final Analysis urges the Commission to adopt policies which facilitate minimization of additional operational and cost burdens on second round licensees. To the extent possible, second round licensees should be permitted to develop sharing criteria directly with the affected U.S. agencies and other satellite operators.

IV. THE COMMISSION'S PROPOSAL FORMS THE BASIS OF AN APPROPRIATE BAND PLAN

A. There is A Consensus That The Commission's Proposal Is a Good Foundation but Should be Modified

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[35] As Final Analysis stated in its comments, costs associated with switching out user terminal equipment from existing services to new Little LEO alternatives may initially make customers resistant to switching from to Little LEO services. See Final Analysis Comments at Exhibit 1 p.9.

[36] Final Analysis is the only qualified second round applicant to have demonstrated capabilities of implementing this technology. While all of the other new second round applicants are still working with theoretical models and constructs, Final Analysis has actually designed, constructed and tested the spacecraft and ground system technology required to meet all of the requirements proposed in the Notice.

1. The Commission's Plan Does Not Result in Three Functional and Equivalent Systems

Virtually all of the commenters share Final Analysis's view that the Commission's proposal, which is an excellent effort to resolve very complicated issues, is not fully workable in important respects. As described in detail in Final Analysis's Comments, the three systems proposed by the Commission are not equivalent in capacity and are not based upon the most efficient pairings of uplink and downlink spectrum. Importantly, other parties, including Leo One USA, CTA, E-SAT and VITA, agree with Final Analysis that FCC System 1 is not suitable for even a small commercial system. Thus, the Commission's proposal really offers only two commercially viable systems, and does not expressly offer an opportunity to accommodate all four new second round applicants.

Analyses by Final Analysis, Leo One USA and CTA demonstrate that FCC Systems 2 and 3 do not have anywhere near equivalent capacity. While Final Analysis does not agree with either of the measures used by Leo One USA and CTA, their conclusions are instructive.

Leo One USA asserts that FCC System 2 has 1069 Mbits/day of downlink capacity and 975 Mbits/day of uplink capacity and thus has 84% of ORBCOMM's balanced capacity.[37] According to Leo One USA, FCC System 3 has only 983 Mbits/day downlink

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[37] See Leo One USA Comments at 32. Leo One USA's use of a Mbit/day measure is not a good comparison given the time sharing constraints. Comparing total capacity available to ORBCOMM with that available to a second round Little LEO operator in the FCC's proposed system does not alter the fact that a second round Little LEO operator will be subject to significant coverage outages due to sharing obligations while ORBCOMM will not. These coverage outages will occur irrespective of the amount of capacity under the Commission's proposed framework. In addition, the comparison is further devalued because a Little LEO operator requires at least 50 kHz of dedicated feeder downlink per satellite.

(continued...)

and 187 Mbits/day uplink, or 16% of ORBCOMM's balanced capacity. Leo One USA also notes that while in FCC System 2 sharing with NOAA is not onerous and that certain bands will be available for 100% duty cycle in a few years, the proposed sharing regime with DOD will prevent provision of near real time services, and uplink spectrum assigned to that system is restricted to land-only transmissions.

CTA focuses on the number of 10 kHz channels, concluding that sharing constraints, neither FCC System 2 nor 3 would support more than a couple of "small"[38] constellations or one "large"[39] constellation.[40] VITA notes that total spectrum "assigned" to FCC System 2 is 1,905 kHz, while FCC System 3 is assigned 810 kHz of spectrum.[41]

Final Analysis and ORBCOMM stress that the actual capacity of each of FCC Systems 2 and 3 is further dependent upon time sharing obligations. In particular, as mentioned above, Final Analysis shows that in FCC System 2, service would be available

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[37](...continued)
Furthermore, the ratio used by Leo One USA (required feeder link over total spectrum in the downlink direction (15.6 percent) is system dependent and cannot be applied linearly as a measure of spectrum requirement.

[38] CTA defines a "small-to-medium" constellation as requiring at least five 10 kHz uplink channels and 40-80 kHz of downlink spectrum. See CTA Comments at 18-20.

[39] CTA defines a "large" constellation as requiring at least ten 10 kHz channels and at least 130 kHz of downlink spectrum. See id.

[40] CTA's analytical focus on the amount of spectrum available for channels is misplaced. The critical issue that is presented to Little LEO operators under the Commission's proposed system is that no coverage outage would be tolerable on feeder links. As demonstrated in the Negotiated Rulemaking, feeder links require at least 50 kHz of dedicated spectrum (in each direction). The issue therefore is not the amount of spectrum but the amount of dedicated spectrum available to Little LEO system operators in order to avoid coverage outages.

[41] VITA Comments at 4.

only an average of 65% of the time and probably less frequently at more northern latitudes. Availability of FCC System 3 cannot be accurately predicted because of the lack of data, but may reasonably be estimated to be less than 65 percent.[42] ORBCOMM also notes that sharing with first round licensees, as well as U.S. government agencies and foreign systems will reduce coverage and availability in of both FCC proposed systems. Finally, Final Analysis and ORBCOMM agree that capacity is even further reduced by the fact that feeder link spectrum must be dedicated and cannot be shared.

Comparing the proposed FCC systems with one another or with ORBCOMM's system on the basis of bare bandwidth is an insignificant comparison if the availability varies greatly. Instead, the Commission should look at the relative availability of dedicated feeder links and the percentage of outage required for inter-system coordination. Under this approach, the three FCC systems may be compared with ORBCOMM's system as follows:

	Spectrum[43]		Dedicated	
System	Uplink (kHz)	Downlink (kHz)	Feeder links	Outage%
ORBCOMM	320	955	Yes	0

[42] Final Analysis notes that there is a typographical error in its discussion of Little LEO System - 3 in its comments. In analyzing the Commission's parameters for modeling interference potential between the Little LEO System - 3 operator (called "TYPSAT" for purposes of Final Analysis's discussion) and the DoD footprint, Final Analysis stated that "[a] TYPSAT user may not be in view of the TYPSAT satellite yet the TYPSAT footprint and the DoD footprint may still overlap." See Final Analysis Comments at 23. Final Analysis's comments should have stated that "[a] TYPSAT user may not be in view of the DoD satellite yet the TYPSAT footprint and the DoD footprint may still overlap."

[43] The spectrum reflected in this table is illustrative, and taken from the information provided in the Notice. Several commenters have noted that an assessment of the amount of spectrum available for uplinks and downlinks may not be accurate due to incorrect or incomplete information in the Commission's proposal. See GE-Starsys Comments at 15-18; Orbcomm Comments at 32-33; VITA Comments at 7. Final Analysis does not suggest that the Commission rely upon the numbers presented here for any actual quantitative analysis.

System 1	46.7	90	No	22[44]
System 2	453	905	No	35
System 3	710	100	No	>35

In summary, Final Analysis and other parties agree that the allocations of spectrum among the three systems are unequal and more limited than might be initially apparent. It is true that the applicant's proposals are varied and that it is not necessarily true that each applicant requires an equivalent band, the characteristics of the FCC's proposed systems do not reflect the different characteristics of the applicant's proposed systems. The FCC's proposal also does not reflect appropriate proportions of uplink and downlink spectrum to maximize efficient implementation of NVNG MSS systems.

2. The Commission's Proposal Encourages Rather than Avoids Mutual Exclusivity

The Commission's proposal also unnecessarily would encourage rather than avoid mutual exclusivity. First, on its face the proposal does not accommodate all second round applicants so there is a virtual guarantee that at least some mutually exclusive amended applications would be filed. Second, the Commission has expressly deemed each proposed segment to be unique and has determined that applications filed for each system will be considered mutually exclusive. In fact, the Notice leaves the second round applicants with little choice but to submit amendments applying in the alternative for all three band segments. Thus, as a practical matter, the Commission's proposal would most likely result in mutually exclusive proposals for each of the three systems.

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[44] The outage in Little LEO System 1 is less than in Little LEO System 2 or Little LEO System 3 because the Little LEO licensee would be required to share only with one satellite, VITA, in System 1, as opposed to five satellites in Systems 2 and 3.

The Commission should strive to avoid mutual exclusivity to the greatest extent possible. The Commission is actually obligated to try to avoid mutual exclusivity before any consideration may be given to the use of auctions. Final Analysis and other parties have presented a compelling case that mutual exclusivity in this proceeding is unnecessary and counterproductive.

In particular, Final Analysis believes that mutual exclusivity can be avoided in at least two ways, either by (i) identifying four equivalent band segments, as Final Analysis has proposed in its Comments, or (ii) designing a customized band plan which accommodates, as much as possible, the specific characteristics of each of the applicants' systems in accordance with the public interest. Final Analysis has proposed such a plan in its comments. Based on the comments of the other parties, Final Analysis also believes that Leo One USA's proposal may be workable. These alternatives are discussed further below.

B. Alternatives Have Been Proposed That Achieve More Balanced Systems and Avoid Mutual Exclusivity

1. Review of Objectives

Final Analysis urges the Commission to adopt the following explicit objectives in resolving this proceeding: (i) avoidance of mutual exclusivity and authorization of all new second round applicants as possible; (ii) avoidance of warehousing of spectrum; (iii) efficient assignment of currently available spectrum and (iv) promotion of a fully competitive NVNG MSS market through commitment to assign future spectrum to current licensees.

In its endeavors to meet these objectives, Final Analysis also urges the Commission to recognize and take full advantage of the unique characteristics of NVNG MSS technologies and markets. NVNG MSS systems are unlike any other satellite systems the Commission has

previously licensed, including Big LEOs. NVNG MSS systems are characterized by constellations that may vary greatly in size and operational parameters. Aside from the fact that they all operate in frequencies below 1 GHz and the common need for dedicated feeder links, these systems may differ widely in number of satellites, orbital design and altitude, modulation techniques, and frequencies used, including proportions of uplink and downlink spectrum. Depending upon the market plan, some systems require less service downlink than others. Also, these constellations will be implemented in stages, with nearly every operator acknowledging that it takes at least two years to get the first two satellites in orbit and five or more years to implement a full constellation.

Markets for NVNG MSS services also are enormously varied and different markets may be reached at different stages of implementation, with the possibility of offering viable commercial services even with just one satellite in orbit. These systems can share frequencies with both terrestrial and other satellite systems through a variety of means, including band segmentation, use of low power flux density, frequency modulation and frequency hopping as well as spread spectrum techniques. However, in order for a constellation to function, these systems require at least 50 kHz for a dedicated feeder link in each direction for the initial satellite and approximately 150-300 kHz of dedicated spectrum for a satellite constellation with overlapping footprints.

Final Analysis also urges the Commission to expressly recognize that the record does not really support the notion that fully competitive systems that will be able to offer near real time services can be authorized in the spectrum that is available here. Final Analysis believes that it is critical for the achievement of a fully and fairly competitive NVNG MSS market in the future to adopt policies now that facilitate the earliest possible introduction of

such near real time services by both first and second round licensees. However, Leo One USA is the only party to assert that near real time services can be provided in the available spectrum, and as Final Analysis has demonstrated, the validity of those assertions is highly questionable.

2. Final Analysis Conditionally Supports Modifications Proposed by CTA, E-SAT and Leo One USA

In its Comments, Final Analysis offered three proposals to resolve potential mutual exclusivity and accommodate all of the new second round applicants. Final Analysis stands by those recommendations and continues to believe that they offer a variety of workable solutions to this proceeding in a manner that would achieve all of the objectives outlined above. However, in recognition of the comments filed by the other second round applicants, and in an effort to find the most expeditious and agreeable solution, Final Analysis here proposes a fourth solution which combines the suggestions of E-SAT, CTA and Leo One USA.

In particular, E-SAT has commented that a final band plan should accommodate an additional CDMA or spread spectrum system.[45] Final Analysis agrees, and would support a final band plan that accommodates this concern, subject to avoidance of interference with first round licensees and the imposition of any unnecessary additional operational constraints, such as power limitations, on the remaining applicants who propose operation in the FDMA/TDMA mode. Final Analysis believes that, as long as E-SAT and GE Starsys can come to agreement on how to share operations in the CDMA mode, then coordination can be

[45] See E-SAT Comments at 13.

achieved with the other FDMA/TDMA operators. Acceptance of E-SAT's proposal removes the need to identify a separate system for their exclusive use.

Next, as all commenters have agreed that FCC System 1 is not useful for a stand-alone commercial system, Final Analysis agrees that this spectrum could be combined with that of FCC System 3 as proposed by CTA and Leo One USA.[46] Leo One USA refers to this revised proposal as "System A." The remaining downlink frequencies, which are essentially the same as FCC System 2, Leo One USA refers to as "System B."[47]

Final Analysis agrees to Leo One USA's proposal identifying System A and System B with one essential condition and clarification. This is that the CTA proposal be amended to reflect what now appears to be its revised market plan to target low polling frequency (or high latency) markets. CTA has estimated that such a system would require 40-80 kHz of spectrum. Final Analysis believes that all four applicants could be accommodated in the two-system plan advanced by Leo One USA if CTA agreed to so modify its system. In that case, CTA could share with either one or both of Leo One USA or Final Analysis, each of which would be licensed to either System A or B.

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[46] See CTA Comments at 23; Leo One USA Comments at 33-34.

[47] See Leo One USA Comments at 34.

V. THE COMMISSION SHOULD ASSIGN APPLICANTS TO SPECIFIC BANDS ON THE BASIS OF PUBLIC INTEREST FACTORS

A. Spectrum Bands Should be Considered Fungible To Avoid Mutual Exclusivity

As discussed, the record clearly supports the adoption of a band plan, from among the alternatives presented, that will achieve the appropriate objectives of this proceeding, including avoidance of mutual exclusivity. A critical component of achieving an appropriate solution from among the alternatives presented is the determination that each of the alternative systems is functionally equivalent and fungible for the purposes of assignment.

As Final Analysis has argued in its Comments, there is abundant support in case law for such an approach, even where the subject of the assignment (e.g., orbital locations or spectrum blocks) are not precisely the same or give each licensee exactly the same functionality. Final Analysis proposes that the Commission consider spectrum bands to be equivalent for the purpose of assigning NVNG MSS systems as long as they each: (i) provide sufficient dedicated feeder link spectrum to support a full constellation (comparing similar sized constellations -- small (under 20 satellites) or large (20 satellites or more), (ii) provide essentially the same number of channels, as measured in kHz, and (iii) permit essentially equivalent proportions of global coverage. As long as all of the applicants can be accommodated within such a framework, there would be no mutual exclusivity issue.

Final Analysis believes that any of the three proposals advanced in its Comments, and the additional proposal discussed herein would meet the proposed standard. The solutions proposed by Final Analysis in its Comments identify four separate but fungible systems that can be assigned to the four new second round applicants. The new proposal discussed above would achieve the fungibility in a slightly different way.

Specifically, Leo One USA's proposed Systems A and B would be fungible with one another for the purpose of each accommodating a single large system, and also would be fungible in the sense that they would each permit sharing with one small constellation.[48] Because E-SAT could be licensed to use CDMA across all of the frequencies, Systems A and B would be available for assignment to three entities while still avoiding mutual exclusivity. For example, Systems A and B each may be individually assigned to each of two proposed large constellations (e.g., Leo One USA and Final Analysis). A small constellation (e.g., CTA) could be assigned to share either or both of Systems A and B. Under this approach, all applicants can be accommodated according to individual business plans.[49]

B. Spectrum Assignments Should Be Made On The Basis Of Public Interest Factors

Under an approach identifying fungible spectrum bands, the only remaining issue would be the assignment of System A or B to either of the two large constellations. As no mutual exclusivity would exist, and no issue of dismissal of an application, there would be no issue under Ashbacker[50] requiring resolution pursuant to a hearing, and no basis for conduct of an auction. In such case, the Commission would most appropriately rely upon public interest factors to make an assignment determination.

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[48] Systems A and B are fungible according to Final Analysis's proposed standards because each has approximately the same frequency available for feeder links, has the same downlink capacity and approximately the same availability.

[49] Clearly this approach will work only if CTA does agree to modify its proposal to implement a small constellation, and all of Final Analysis's discussion here is based upon that assumption. Final Analysis would not accept the Leo One USA proposal in the event that CTA maintains its original proposal for a large constellation.

[50] See Ashbacker Radio Corp. v. FCC, 326 U.S. 327 (1945) ("Ashbacker").

The Commission has ample authority to make assignments on this basis. In determining whether a grant of a license is in the "public interest, convenience, and necessity" under Section 309(a), the basic touchstone for the Commission's public interest decision is to regulate interstate and foreign wire and radio communications to make available "a rapid, efficient, Nation-wide, and world-wide wire and radio communication service."[51] With respect to satellite communications, moreover, the Commission's licensing decisions should promote "new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest."[52]

The Commission's traditional satellite licensing policies also support this approach.[53] For example, in the Domsat 2-Degree Spacing Order[54] public interest criteria considered by the Commission in assigning orbital locations included traffic, operational, scheduling requirements and launch dates of applicants.[55] Thus, it is clear that, within a framework of fungible spectrum bands, the Commission has the authority to make specific assignments according to particular public interest factors.

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[51] See 47 U.S.C. § 151; see also Network Project v. FCC, 511 F.2d 786, 793 (D.C. Cir. 1975); Domestic Fixed-Satellite Transponder Sales, 90 F.C.C.2d 1239, 1249 (1982) (the Commission's "mandate set forth in Section 1 of the Act, 47 U.S.C. § 151, is to make available to the public, rapid and efficient communications, so far as possible.").

[52] See 47 U.S.C. § 303(g).

[53] See e.g., Domsat Orbital Deployment Plan, 84 F.C.C.2d 584, 605 (1981).

[54] See Licensing of Space Stations in the Domestic Fixed-Satellite Service and Related Revisions, CC Docket No. 81-704, FCC 83-184, Report and Order (released August 16, 1983) ("Domsat 2-Degree Spacing Order").

[55] See Domsat Orbit Deployment Plan, 84 F.C.C.2d at 605.

In the case of NVNG MSS assignments, public interest considerations may be slightly different than for domsats. Final Analysis proposes that the Commission rely upon the following public interest factors in making any particular assignment: (i) efficiency of spectrum utilization (e.g., maintaining separate bands for large systems but permitting large and small systems to share where feasible); (ii) technical compatibility (e.g., consideration of whether specific proposed system designs are more compatible with particular frequency bands) (iii) implementation schedules (e.g., whether particular assignments may facilitate earlier introduction of service to the public; and (iv) cost factors (e.g., whether particular assignments may facilitate more economical introduction of service and avoid undue cost burdens that may be passed on to consumers -- a factor which is critical for low cost NVNG MSS applications).

C. A Public Interest Approach Easily Dictates Particular Assignments

1. Assignments are Clear Under Leo One USA's Proposal

a. CTA Should Share Systems A and/or B

In the event that the Commission adopts Leo One USA's proposed Systems A and B, Final Analysis believes that specific assignments become clear with appropriate application of the proposed public interest factors. In considering the first public interest factor, efficiency of spectrum utilization, Final Analysis proposes that each of System A and B be specifically, but not necessarily exclusively, assigned to Final Analysis and Leo One USA. CTA should be assigned to either or both of System A or B on an inter-system sharing basis.

b. Final Analysis Should Be Assigned The "Lesser" System A[56]

In considering the second public interest factor, technical compatibility, Final Analysis submits that in two major respects its proposed constellation is the one most compatible with System A. First, beginning with first experimental satellite ("FAISAT-1")[57] and continuing under its current experimental satellite ("FAISAT-2v")[58] as well as construction progressing

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[56] Although as stated above, Final Analysis does not subscribe to Leo One USA's comparative measure based on ORBCOMM's capacity, Final Analysis notes that, in its Comments at 32-35 and in Appendix F, Leo One USA determines that this system has 90% of ORBCOMM's capacity while its proposed System B has 92% of ORBCOMM's capacity. Also, in Appendix F, Leo One USA identifies the relative estimated availability of System A as approximately 97.5%, while System B has 100% availability unitl the year 2002 and after 2006, with near 100% availability during the transition period between latitudes of 20 to 60 degrees. Final Analysis believes that Leo One USA overstates availability because its calculations are based upon a frequency hopping strategy which, as explained herein, Final Analysis does not believe is economically implementable for a competitive system. Also, Final Analysis believes that Leo One USA understates the outages in System A due to cordination with VITA. For all of these reasons, Final Analysis believes that neither System A nor System B will achieve near real time availability. Additionally System A will have lower availability than System B due to the greater outages required by coordination with VITA and because of the more demanding requirements of coordination with DOD.

[57]In 1994, FAISAT-1 was authorized under an experimental license (Call Sign KE2XGW) to operate and transmit in the 400 MHz (399.8375 MHz and 400.62 MHz) downlink. Final Analysis designed and developed a satellite radio transmitter to operate in this band utilizing GMSK modulation. Final Analysis designed, developed and manufactured ground station receiving radios for the three ground stations associated with FAISAT-1 with anticipated locations in Logan, Utah (Call Sign KE2XGU), Greenbelt, Maryland (Call Sign KE2XGV) and in Albuquerque, New Mexico (Call Sign KE2XGY). Final Analysis also undertook significant research and development efforts for user terminals (Call Sign KE2XGX) associated with FAISAT-1 with receivers in the 400 MHz band.

[58] In 1995, Final Analysis received authorization to construct and launch FAISAT-2v (Call Sign KS2XCY) to operate and transmit in the 400 MHz (400.62 MHz) downlink. Drawing from its experience with FAISAT-1, Final Analysis is investing additional R&D on FAISAT-2v radios to enhance and increase their capabilities and efficiency. Final Analysis is modifying and upgrading its ground stations (and therefore the receiving ground radios) that can now perform day-to-day operation of the entire commercial constellation. In addition, Final Analysis is developing user terminals (Call Sign KS2XCZ) that incorporate

(continued...)

under its Section 319(d) waiver,[59] Final Analysis is exploring operational boundaries of Little LEO service on the 400-401 MHz downlink and potential methods for optimizing coexistence with other users of that spectrum. Final Analysis already has developed software and hardware for its experimental operations in the 400-401 MHz band. That infrastructure includes radios and associated components integrated into the two spacecraft, the ground stations and user terminals. Also, as part of its experimental licensing program, Final

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[58](...continued)
the advance radio technology Final Analysis has developed for FAISAT-2v. These terminals receive in the 400 MHz band.

[59] See Letter from Donald H. Gips, Chief, International Bureau, FCC to Aileen Pisciotta, dated September 20, 1996 (granting Final Analysis's request (File No. 144-SAT-WAIV-96) for a Section 319(d) waiver to construct two satellites of its proposed non-voice non-geostationary mobile satellite service system) ("Final Analysis Section 319(d) Waiver Grant"). Final Analysis is well aware that construction of its satellites under its Section 319(d) waiver and experimental authorization is at its own risk with respect to obtaining a license. See Final Analysis Section 319(d) Waiver Grant. Furthermore, the Commission expressly stated in adopting its 1992 guidelines that, while the experimental satellite licensing program is designed to promote satellite investment, experimentation and innovation, the costs of the program are to be incurred at the licensee's own risk and do not "create an expectation that sizeable investments in an experiment necessitate or mandate any particular course of action by the Commission in future proceedings." See Policy Statement on Experimental Satellite Applications, 70 Rad. Reg. 2d (P&F) 1581, 1582 (1992). Final Analysis readily accepts these conditions as part of its experimental program and does not argue here that its investment in the experimental program should compel the Commission to grant it a license. Nevertheless, assuming that the Commission otherwise finds Final Analysis qualified to receive a second round Little LEO license, the Commission reasonably may consider operational parameters, development and design of Final Analysis's experimental satellite system in determining what frequency assignments for Little LEO systems would be in the public interest. Indeed, the Commission has recognized the public interest benefits of initial experimental programs in formulating permanent spectrum licensing policies and rules in the Domsat at service and terrestrial automatic vehicle monitoring service. See, e.g., Domsat II, 35 F.C.C. 2d at 844-847; Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems, 10 FCC Rcd 4695 at ¶¶ 3-4 (1995).

Analysis has already conducted extensive R&D and established infrastructure using the 400-401 MHz band for downlink operations with its experimental FAISAT-2v satellite.[60]

Regarding the third public interest factor, early implementation of service to the public, Final Analysis has the best technology to perform the particular time sharing functions required by the Commission for use of this spectrum. Final Analysis has made strong public interest showings in its various presentations before the Commission and in international radioconference proceedings that it has the most advanced and efficient technical capability among second round applicants to meet and exceed future coordination and sharing requirements that may arise with regard to other users and operators in the 400-401 MHz band.[61] In particular, Final Analysis has the capability of tuning its spacecraft to different frequencies over a large band, and already has multiple ground stations located both domestically and internationally, as will be required to uplink frequent commands to individual satellites in the constellation.[62]

With respect to the third criterion, implementation schedules, Final Analysis is best positioned to initiate service earlier than any of the other second round applicants, if it is assigned downlink spectrum in the 400-401 MHz band. With its experimental program in place and Section 319(d) waiver, Final Analysis is the only one of the second round applicants to be actively constructing its satellite system. Final Analysis also has fully

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[60]See discussion of FAISAT-1 and FAISAT-2v supra.

[61]One of the main purposes of Final Analysis's experimental program under FAISAT-1 and FAISAT-2v is to explore methods of coordination and sharing with other users and operators in the 400-401 MHz band.

[62] See Letter from Peter A. Batacan, Counsel for Final Analysis to Office of Engineering & Technology, regarding status of FAISAT-2v, dated December 13, 1996.

committed launch capability through its arrangement with Polyot for its entire constellation. This means that it will be able to place satellites in orbit well before any of the other applicants, assuming that the engineering it has already performed is utilized. On the other hand, if Final Analysis is required to completely re-engineer its system, significant delays could result.

With respect to the fourth public interest factor, cost, for the reasons cited above Final Analysis is operationally best positioned among second round applicants to begin commercial operations on the 400-401 MHz downlink without incurring additional start-up costs and therefore to bring economical service to consumers.

c. Leo One USA Should Be Assigned the "Greater" System B

Although Leo One USA has not declared a preference for either System A or B, Final Analysis submits that assignment of System B would be appropriate. In light of the strong reasons for assigning System A to Final Analysis, and in light of the slightly greater capacity in System B and Leo One USA's apparent preference for and expressed comfort with sharing circumstances in requirements in those bands, assignment of System B to Leo One would best meet the public interest test.

Under the criterion of technical compatibility, Leo One has not yet made any specific demonstrable technical commitments to particular frequency bands and thus apparently would be equally able to operate in System A or B. Also, Leo One USA indicates in Appendix F at 20 its "high confidence" it its ability to share with the MetSat constellation. Finally, as Leo One USA represents that it is willing to implement a frequency avoidance "step or hop" concept to achieve maximum availability to provide near real time service, and since even under such techniques maximum availability as calculated by Leo One USA in System A is

97.5% (less than the 99% required to provide near real time service as defined by Leo One USA),[63] while in System B it is 100%, Leo One USA appears to have greater technical compatibility with System B.

Assignment of System B to Leo One USA would not appear to cause any delays in construction or implementation of their constellation, and thus this assignment would be consistent with a public interest criterion of avoiding delayed implementation.

Finally, assignment of System B to Leo One USA also is consistent with the fourth criterion of avoiding undue costs to consumers. Leo One USA maintains that it can achieve near real time service within its proposed systems. Final Analysis disputes that this is practicable due to the additional costs that must be incurred, and passed on to consumers, for terminals capable of receive frequency hopping as well as for the other coordination techniques proposed by Leo One USA. Final Analysis believes that such additional costs may be minimized if Leo One USA uses System B as it appears to offer potential for 100% availability (under Leo One USA's measure) in the most highly populated latitudes for at least certain periods of time. Thus, overall benefits to the public may be greater if Leo One USA is permitted to attempt its proposed sharing techniques in this spectrum band.

2. Under Its Own Proposals Final Analysis Should Be Assigned An Appropriate System In The 400-401 MHz Downlink Spectrum

The above discussion and analysis is presented to assist the Commission in achieving a result in this proceeding that accommodates, to the greatest extent possible, the public

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[63] Final Analysis also questions Leo One USA's availability analysis of System A given the fact that Leo One USA's Comments otherwise show significant outages due to DOD DMSP coordination. See Leo One Comments, Appendix E p. 33, showing that 25-28 of its 48 satellites will have significant coverage outages.

interest in efficient and expeditious introduction of service as well as the various technical and business plans of the parties. However, as Final Analysis originally proposed in its comments, at least three other alternatives exist for identification of four equivalent, customized or shared systems that will permit licensing of all four second round applicants while avoiding mutual exclusivity.[64] Final Analysis remains confident that either of these alternatives would provide a viable solution for this proceeding.

In the event that the Commission elects to use one of Final Analysis's three alternative approaches, the same public interest test could be applied for assignment of individual applicants to particular bands. Final Analysis submits that in such case the public interest would best be served by assigning it spectrum in the 400-401 MHz downlink bands. Also, Final Analysis itself would favor an assignment plan pursuant to which this downlink spectrum was specifically available for feeder links. In this way, the stringent frequency modification restrictions required for coordination with DOD could be made to affect only the ground stations, and not subscriber terminals. This would further serve the public interest by making it possible to keep the cost of subscriber terminals as low as possible.

VI. THE RECORD IS CLEAR THAT THE COMMISSION MAY NOT USE AUCTIONS IN THIS PROCEEDING

The record virtually unanimously supports the conclusion that, even if mutual exclusivity cannot be avoided, use of auctions for Little LEO services would be very ill-advised.[65] As global service providers, Little LEO licensees will require landing rights in

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[64] See Final Analysis Comments at 25 and Exhibit 3.

[65] Leo One USA comments that it, too, is opposed to auctions. Leo One USA Comments at 61. Curiously, Leo One USA further asserts that, in the event mutual

(continued...)

individual countries around the globe, will use shared spectrum and will require additional spectrum allocations. Commenters overwhelmingly agree that auctions actually could doom the U.S. NVNG MSS industry by creating overwhelming delay, uncertainty and investment risk, and may imperil other segments of the U.S. satellite industry as well as other national interests. Moreover, other techniques are available to resolve any potential mutual exclusivity, that may exist that would not undermine the Commission's goals for the Little LEO service.

A. A Decision to Auction NVNG MSS Spectrum Is Premature

As Final Analysis argued in its comments, a decision to use auctions to grant Little LEO licenses is premature where the Commission has alternative methods available to resolve potential mutual exclusivity.[66] Moreover, commenters support the conclusion that it is too early to propose an auction framework when the particular parameters of second round systems have not yet been determined, and it is not yet apparent whether mutual exclusivity indeed exists or whether any mutual exclusivity that does exist can be resolved through engineering or other solutions.[67]

B. Auctions Are Inherently Unsuitable for Global Satellite Systems.

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[65](...continued)
exclusivity cannot be resolved, it would favor use of auctions over any other approach for the ostensible reason that this would permit most expeditous licensing. See id. at 62. Especially in light of the comments submitted by all of the other parties on this issue, Leo One USA's position reveals a lack of understanding about the international marketplace and what is involved in implementing a global system. Leo One USA's position on this issue is simply not credible.

[66] See Final Analysis Comments at 36-39.

[67] See, e.g., VITA Comments at 9.

Even if a decision to use auctions were not premature, however, auctions are nonetheless inherently unsuitable in the context of Little LEO services. While auctions offer demonstrated benefits in the terrestrial wireless context in preventing speculation and trafficking in licenses, there is no actual or potential threat of such anticompetitive conduct in the Little LEO context that would reasonably require the imposition of an auction framework.[68] Furthermore, the record shows that the complexities and uncertainties associated with the global nature of Little LEO services, such as issues relating to international reciprocity and comity, pose additional barriers to licensing not presented by licensing of exclusively domestic services.[69]

A decision by the Commission to license Little LEO spectrum by auction also will disadvantage the U.S. NVNG MSS industry to the extent that it would lead foreign countries to use auctions in licensing Little LEO spectrum or lending rights.[70] The Commission's auction decisions have a precedent-setting effect on other countries' licensing regimes, and a U.S. Little LEO auction would therefore most likely lead to global sequential auctions.[71]

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[68] See Lockheed Martin Comments at 9. Furthermore, to the extent that auctions were beneficially employed in licensing the Direct Broadcast Satellite ("DBS") service, the pre-coordination of DBS frequencies through adoption of a global ITU Broadcast Satellite Service plan substantially minimized the potential for controversy and delay that otherwise would have arisen from auctioning spectrum prior to international coordination. See, e.g., Orbcomm Comments at 47. With respect to Little LEO services, international coordination has not been predetermined and would increase delay associated with a prospective auction.

[69] See, e.g., Lockheed Martin Comments at 3; SIA Comments at 3; Iridium Comments at 5; Orbcomm Comments at 50; GE-Starsys Comments at 23.

[70] See, e.g., L/Q Licensee Comments at 2-5.

[71] See Iridium Comments at 9; Lockheed Martin Comments at 3-4; VITA Comments at 9; GE-Starsys Comments at 23; see also Martin Spicer, International Survey of Spectrum Assignment for Cellular and PCS (September 1996).